

June 1995



Biology 30
Grade 12 Diploma Examination

Alberta
EDUCATION

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June 1995

Biology 30

Grade 12 Diploma Examination

Description

Time: 2.5 h. You may take an additional 0.5 h to complete the examination.

Total possible marks: 80

This is a **closed-book** examination consisting of

- 48 multiple-choice and 8 numerical-response questions, each with a value of one mark
- 2 written-response questions, each worth 12 marks

This examination contains sets of related questions.

A set of questions may contain multiple-choice and/or numerical-response and/or written-response questions.

When required, a grey bar is used to indicate the end of a set.

Tear-out data pages are included near the back of this booklet.

The blank perforated pages at the back of this booklet may be torn out and used for your rough work. No marks will be given for work done on the tear-out pages.

Instructions

- Fill in the information required on the answer sheet and the examination booklet as directed by the presiding examiner.
- You are expected to provide your own scientific calculator.
- Use only an HB pencil for the machine-scored answer sheet.
- If you wish to change an answer, erase **all** traces of your first answer.
- Consider all numbers used in the examination to be the result of a measurement or observation.
- Do not fold the answer sheet.
- The presiding examiner will collect your answer sheet and examination booklet and send them to Alberta Education.
- Read each question carefully.
- Now turn this page and read the detailed instructions for answering machine-scored and written-response questions.

Multiple Choice

- Decide which of the choices **best** completes the statement or answers the question.
- Locate that question number on the separate answer sheet provided and fill in the circle that corresponds to your choice.

Example

This examination is for the subject of

- A. biology
- B. physics
- C. chemistry
- D. science

Answer Sheet

● (B) (C) (D)

Numerical Response

- Record your answer on the answer sheet provided by writing it in the boxes and then filling in the corresponding circles.
- If an answer is a value between 0 and 1 (e.g., 0.25), then be sure to record the 0 before the decimal place.
- **Enter the first digit of your answer in the left-hand box and leave any unused boxes blank.**

Examples

Calculation Question and Solution

The average of the values 21.0, 25.5, and 24.5 is _____.

(Record your answer to three significant digits in the numerical-response section of the answer sheet.)

$$\begin{aligned}\text{Average} &= (21.0 + 25.5 + 24.5)/3 \\ &= 23.666 \\ &= 23.7 \text{ (rounded to three digits)}\end{aligned}$$

Record 23.7 on the answer sheet →

2	3	.	7
---	---	---	---

●	●		
0	0	0	0
1	1	1	1
2	2	2	2
3	●	3	3
4	4	4	4
5	5	5	5
6	6	6	6
7	7	7	●
8	8	8	8
9	9	9	9

Correct-order Question and Solution

When the following subjects are arranged in alphabetical order, the order is _____.
(Record your four-digit answer in the numerical-response section of the answer sheet.)

- 1 physics
- 2 chemistry
- 3 biology
- 4 science

Answer 3214

Record 3214 on the answer sheet →

3	2	1	4
•	•		
0	0	0	0
1	1	•	1
2	•	2	2
•	3	3	3
4	4	4	•
5	5	5	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Selection Question and Solution

The birds in the following list are numbered _____.
(Record your answer in ascending numerical order in the numerical-response section of the answer sheet.)

- 1 dog
- 2 sparrow
- 3 cat
- 4 robin
- 5 chicken

Answer 245

Record 245 on the answer sheet →

2	4	5	
•	•		
0	0	0	0
1	1	1	1
•	2	2	2
3	3	3	3
4	•	4	4
5	5	•	5
6	6	6	6
7	7	7	7
8	8	8	8
9	9	9	9

Written Response

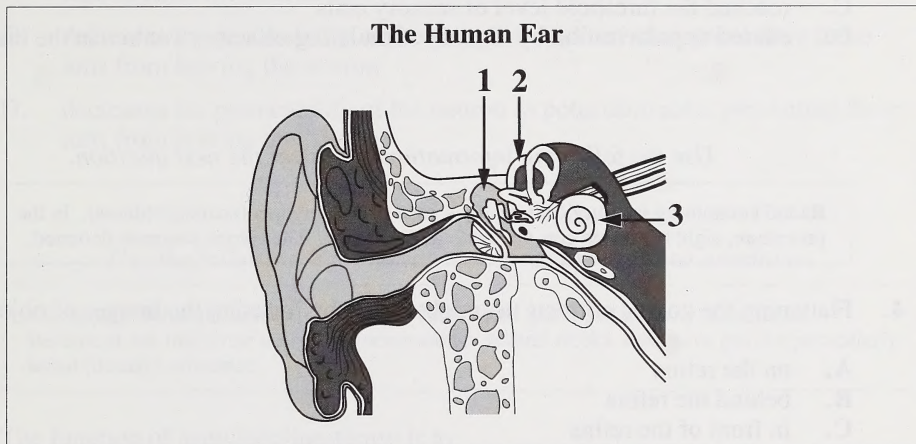
- Write your answers in the examination booklet as neatly as possible.
- For full marks, your answers must be well organized and address **all** the main points of the question.
- Relevant scientific, technological, and/or societal concepts and examples must be identified and explicit.
- Descriptions and/or explanations of concepts must be correct and reflect pertinent ideas, calculations, and formulas.
- Your answers **should be** presented in a well-organized manner using complete sentences, correct units, and significant digits where appropriate.

Do not turn the page to start the examination until told to do so by the presiding examiner.

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In humans, the nervous and endocrine systems maintain equilibrium internally and with the external environment.

Use the following diagram to answer the next question.



1. Which row correctly identifies the state of the matter normally contained within structures 1, 2, and 3?

Row	Structure 1	Structure 2	Structure 3
A	gas	solid	solid
B	liquid	liquid	solid
C	liquid	solid	liquid
D	gas	liquid	liquid

2. Deaf people may be given an electronic device called a cochlear implant. The implant replaces or enhances the function of the specific part of the cochlea related to hearing. This device likely translates
- A. air pressure changes into middle ear bone movements
 - B. membrane vibrations into nerve impulses
 - C. head movements into electrical impulses
 - D. chemical messages into sound waves

3. When a 1.5 volt electric current was applied to a person's tongue, the person sensed a strong taste. When the electric current was removed, the taste disappeared. The electric current apparently
- A. stimulated motor impulse transmission
 - B. increased enzyme production in synapses
 - C. reached the threshold level of sensory cells
 - D. caused depolarization by directly stimulating olfactory centres in the brain

Use the following information to answer the next question.

Radial keratotomy is a surgical technique used to cure myopia (nearsightedness). In the procedure, eight to sixteen cuts are made in the cornea. The cornea becomes flattened.

4. Flattening the cornea corrects nearsightedness by focusing the images of objects
- A. on the retina
 - B. behind the retina
 - C. in front of the retina
 - D. toward the centre of the retina

Use the following information to answer the next question.

A curious child touched the outside of a barbecue grill containing red-hot coals. Before he was even aware of what happened, he jerked his hand away. A second or two later, he felt pain and began to cry.

5. Which is the correct sequence of structures involved in causing the child to remove his hand?
- A. Motor neurons, effectors, sensory neurons, interneurons
 - B. Motor neurons, interneurons, effectors, sensory neurons
 - C. Sensory neurons, motor neurons, interneurons, effectors
 - D. Sensory neurons, interneurons, motor neurons, effectors

6. A nerve impulse is transmitted when a stimulus
- A. increases the permeability of the neuron to sodium ions, allowing these ions to enter the neuron
 - B. increases the permeability of the neuron to potassium ions, allowing these ions to enter the neuron
 - C. decreases the permeability of the neuron to sodium ions, preventing these ions from leaving the neuron
 - D. decreases the permeability of the neuron to potassium ions, preventing these ions from leaving the neuron

Use the following information to answer the next two questions.

Diisopropyl fluorophosphate is a very powerful nerve gas found in many insecticides. Because it can inactivate acetylcholinesterase for several weeks, this nerve gas is a particularly lethal (deadly) substance.

7. The function of acetylcholinesterase is to
- A. promote the synthesis of neurotransmitters in axons
 - B. conduct a nerve impulse from a motor neuron to a muscle fibre
 - C. inactivate acetylcholine by breaking it down into its components
 - D. initiate the fight-or-flight response of the autonomic nervous system
8. Which function of neurons is most likely affected by diisopropyl fluorophosphate?
- A. Active transport
 - B. Protein synthesis
 - C. Myelin formation
 - D. Synaptic transmission

Use the following information to answer the next question.

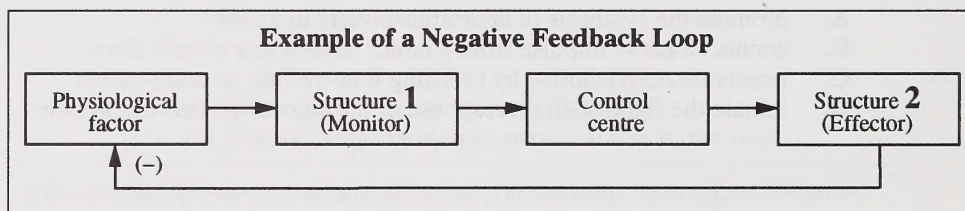
Dopamine and Cocaine

Dopamine is an inhibitory neurotransmitter produced by certain neurons in the brain. One effect of dopamine is that it brings about feelings of pleasure. After release, dopamine is reabsorbed by transmitting neurons.

The illegal drug cocaine stimulates the release of dopamine from transmitting neurons but blocks the reabsorption of dopamine by these neurons. In the body, cocaine slowly breaks down into inactive substances.

9. While under the influence of cocaine, some users report prolonged feelings of pleasure because dopamine
- A. reduces the refractory period of neurons
 - B. remains in the synapse longer than normal
 - C. increases the speed of nerve impulse transmission
 - D. diffuses rapidly throughout the pleasure centres of the brains

Use the following information to answer the next two questions.



10. If the physiological factor controlled by this feedback loop were the maintenance of balance, then **structure 1** would be the
- A. semicircular canals
 - B. medulla oblongata
 - C. motor nerves
 - D. ossicles
11. If the physiological factor regulated by this feedback loop were metabolic rate, then **structure 2** would be the
- A. medulla oblongata
 - B. cerebral cortex
 - C. pituitary gland
 - D. thyroid gland

Use the following information to answer the next question.

Some Glands and Hormones of the Human Body	
Glands	Hormones
1 Pituitary	1 ACTH
2 Thyroid	2 ADH
3 Pancreas	3 Cortisol
4 Adrenals	4 Epinephrine
5 Ovaries	5 FSH
6 Testes	6 Insulin
	7 Testosterone
	8 Thyroxine
	9 TSH

Numerical Response

1. Select a set of numbers for glands and hormones that correctly completes the statement below. (Note: There may be more than one correct answer for this question, but you must provide only one correct set of numbers.)

The _____ secrete(s) _____, which stimulates the _____ to produce _____.
Gland(s) Hormone Gland(s) Hormone

(Record your four-digit answer in the numerical-response section of the answer sheet.)

12. The pituitary is often called the “master gland” because it
- A. receives impulses directly from the brain
 - B. controls every other gland and organ in the body
 - C. secretes hormones that control the functions of exocrine glands
 - D. produces hormones that regulate the activities of other endocrine glands in the body
13. An abnormally large volume of urine may be produced after a person drinks alcoholic beverages. It is likely that ethyl alcohol affects normal secretion of
- A. antidiuretic hormone
 - B. thyroxine
 - C. glucagon
 - D. insulin

Use the following information to answer the next two questions.

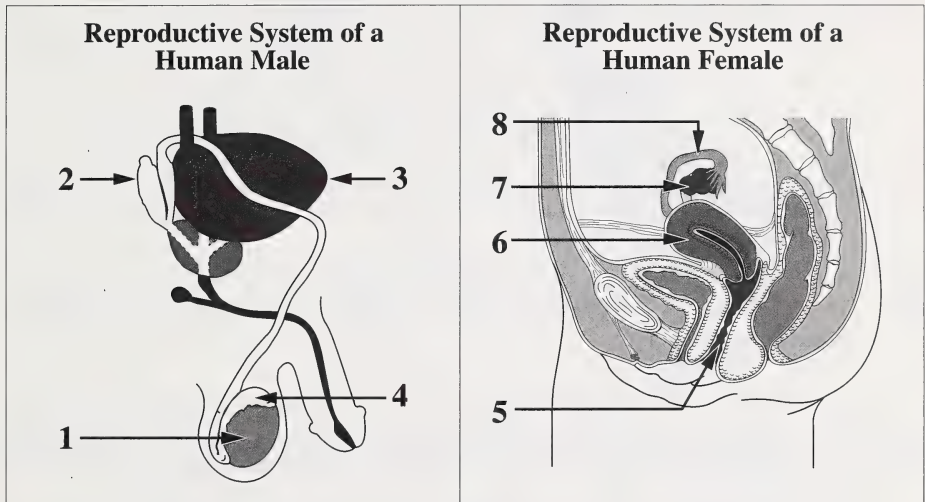
A Treatment for Pancreatitis

Surgical removal of the pancreas is a procedure that doctors use to relieve the pain of patients suffering from chronic pancreatitis (inflammation of the pancreas). Unfortunately, the surgery causes the onset of diabetes mellitus and other complications in these patients. In a recent study involving five individuals who had undergone this treatment, islet cells from the removed pancreas were infused (transplanted) back into the liver of each patient. This procedure effectively eliminated the occurrence of diabetes in these patients.

14. Blood glucose levels are kept relatively constant by a negative feedback mechanism. The islet cells are part of this mechanism. The role of these cells is to secrete
- A. glucagon to raise blood sugar levels and to secrete insulin to lower blood sugar levels
 - B. glucagon to lower blood sugar levels and to secrete insulin to raise blood sugar levels
 - C. glucagon and insulin, both of which lower blood sugar levels
 - D. glucagon and insulin, both of which raise blood sugar levels
15. Patients who participated in this study no longer have a pancreas. To maintain normal body functions in these patients, the infusion of islet cells would have to be accompanied by daily
- A. ingestion of glycogen to stimulate liver function
 - B. injection of hormones to promote glycogen release from the liver
 - C. injection of digestive enzymes into the blood to maintain nutrient levels
 - D. ingestion of digestive enzymes to replace those produced by the pancreas

Humans have chemically regulated reproductive systems that ensure survival of the species.

Use the following diagrams to answer the next two questions.



Numerical Response

2. Select the number that identifies each male or female structure described below.

Structure: _____

Description:	Stores mature sperm	Produces non-cellular components of seminal fluid	Produces ova	Normal site of fertilization
--------------	---------------------	---	--------------	------------------------------

(Record your four-digit answer in the numerical-response section of the answer sheet.)

16. Testosterone is produced by the
- A. interstitial cells of structure 1
 - B. seminiferous tubules of structure 1
 - C. interstitial cells of structure 4
 - D. seminiferous tubules of structure 4

17. Recently, efforts to develop a male birth control pill with few side effects have focused on drugs that block the production of FSH. The research did not focus on blocking LH production because decreased LH production would
- A. trigger a decrease in FSH production
 - B. reduce testosterone production
 - C. inhibit pituitary activity
 - D. reduce sperm motility

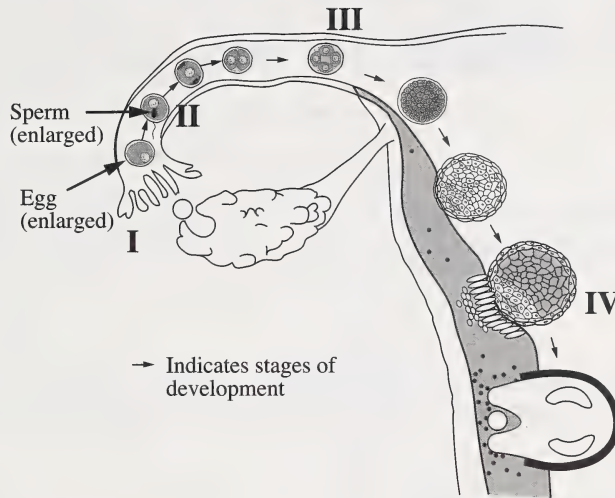
Use the following information to answer the next two questions.

At the time of birth, the ovaries of a baby girl contain 300 000 to 400 000 immature eggs. Each immature egg is surrounded by a layer of cells. These eggs remain at an immature stage until the girl reaches puberty.

18. Which hypothesis is a likely explanation for the eggs remaining at an immature stage for many years?
- A. The pituitary secretes relaxin, which prevents the ovaries from maturing.
 - B. The developing ovaries secrete high levels of estrogen, which prevents the maturation of eggs.
 - C. The undeveloped uterus secretes insufficient progesterone to stimulate the formation of a follicle.
 - D. The hypothalamus secretes insufficient hormones to stimulate gonadotropin secretion by the pituitary.
19. Which hormone causes the immature eggs to start developing at puberty?
- A. FSH, secreted by the pituitary
 - B. High levels of LH, secreted by the follicle
 - C. Progesterone, secreted by the endometrium
 - D. High levels of estrogen, secreted by the egg

Use the following information to answer the next two questions.

Some Early Stages in the Development of a Human Fetus



20. Which row correctly identifies each numbered stage in the developmental process?

Row	Stage			
	I	II	III	IV
A	oogenesis	ovulation	meiosis	implantation
B	ovulation	fertilization	mitosis	implantation
C	ovulation	fertilization	meiosis	parturition
D	oogenesis	ovulation	mitosis	parturition

21. At the completion of each successive cell division during stage III, the

- A. volume of cytoplasm per cell is increased
- B. number of chromosomes per cell is doubled
- C. number of chromosomes per cell is reduced by half
- D. cytoplasmic contents are approximately equally distributed

22. Which row correctly matches the description of a normal human cell with its sex chromosome complement?

Row	Sex Chromosome Complement	Description of a Normal Cell
A	XX	an unfertilized egg that will develop into a female
B	X	a zygote that will develop into a male or a female
C	XY	a zygote that will develop into a male
D	Y	a sperm that will develop into a male

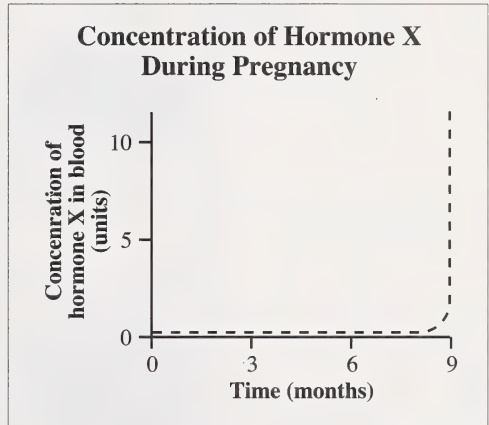
23. Which hormone must circulate through the blood vessels of the uterus to maintain a fully developed endometrium, thereby ensuring successful implantation of an embryo?

- A. LH
- B. FSH
- C. Oxytocin
- D. Progesterone

24. Chorionic gonadotropin is produced by the cells surrounding an embryo. It functions similarly to the hormone that stimulates the corpus luteum to secrete progesterone at relatively high levels. The hormone that functions similarly to chorionic gonadotropin is

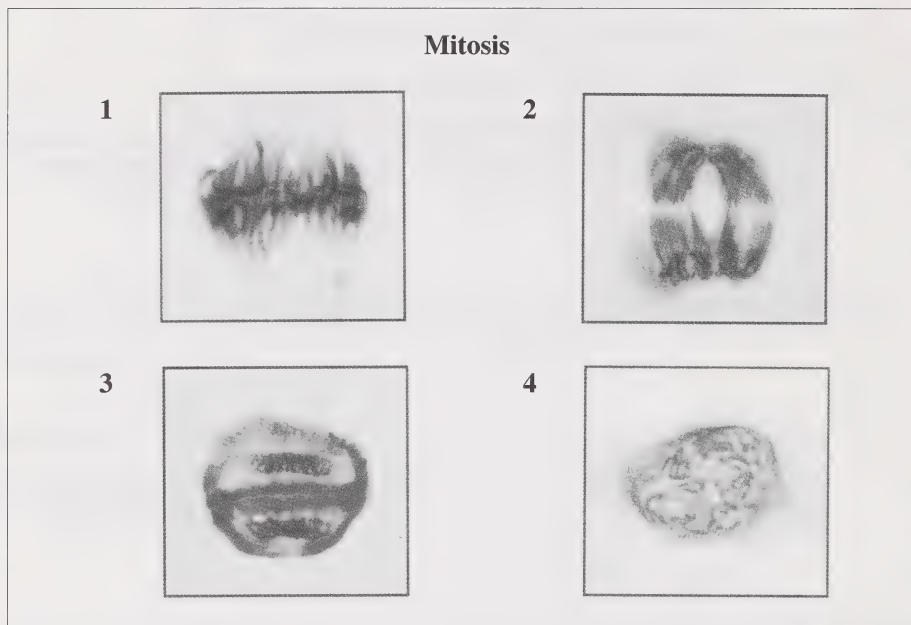
- A. oxytocin
- B. relaxin
- C. FSH
- D. LH

25. The first, second, and third trimesters of pregnancy correspond directly to the
- A. formation of the three germ layers of an embryo
 - B. regulation of fetal development by estrogen, progesterone, and oxytocin
 - C. organization of human prenatal development into three equal time periods
 - D. fertilization of an ovum, implantation of a blastocyst, and parturition of a fetus
26. Based on the graph at the right, the best hypothesis is that hormone X is
- A. FSH
 - B. estrogen
 - C. oxytocin
 - D. progesterone



Research by scientists has revealed information about the structure and function of chromosomes and DNA.

Use the following photographs to answer the next question.



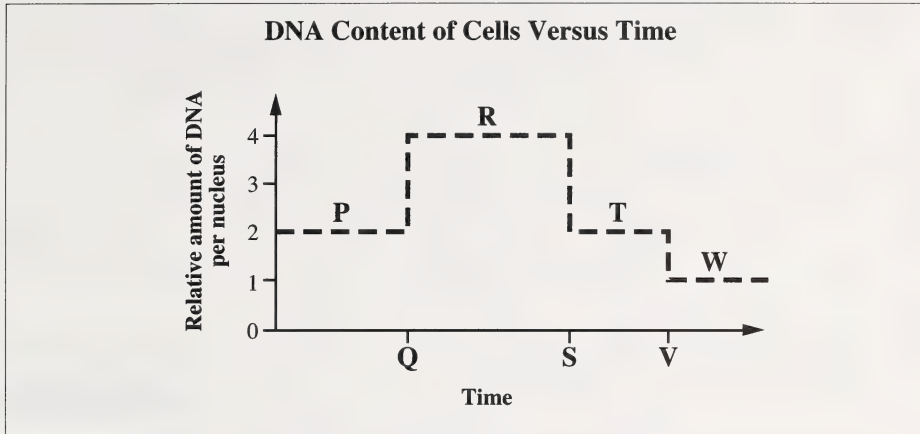
Numerical Response

- 3.** Normal cell division (mitosis) is a process involving a specific sequence of events. Provide the correct sequence of the mitotic events shown in the photographs.

Answer: _____

(Record your four-digit answer in the numerical-response section of the answer sheet.)

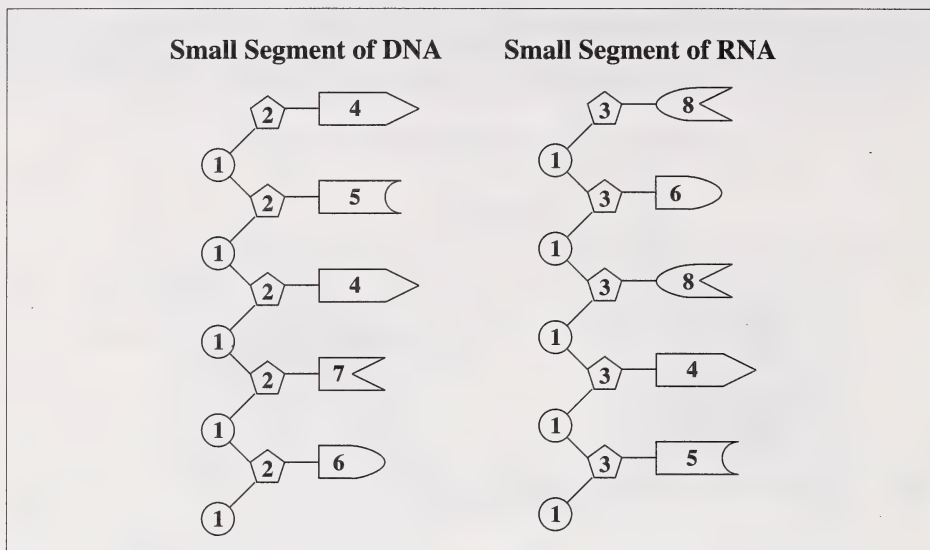
Use the following information to answer the next question.



27. Diploid cells would be present at stage(s)

- A. P and T
- B. Q and S
- C. R only
- D. W only

Use the following diagrams to answer the next question.



Numerical Response

4. The molecules ribose sugar, deoxyribose sugar, uracil, and thymine, respectively, are labelled with which numbers?

Answer : _____
 Molecule: Ribose Deoxyribose Uracil Thymine
 Sugar Sugar

(Record your four-digit answer in the numerical-response section of the answer sheet.)

28. During transcription, genes function as
- A. a source of amino acids
 - B. templates for nucleotide sequences
 - C. enzymes that bond tRNA with mRNA
 - D. a storehouse for phosphate bond energy

Use the following information to answer the next question.

Some Amino Acids

- 1 Aspartate
- 2 Cysteine
- 3 Glutamate
- 4 Histidine
- 5 Leucine
- 6 Phenylalanine
- 7 Proline
- 8 Tryptophan

Numerical Response

- 5.** Provide the correct sequence of numbers that represent the amino acids coded by the DNA nitrogen-base sequence shown below. Read the DNA code beginning at the left.

– G – G – T – G – G – G – C – T – A – A – C – A –

Answer: _____

(Record your answer in the numerical-response section of the answer sheet.)

Use the following information to answer the next question.

Factors Related to Cancer

1. Many types of cancer are known to be inherited.
2. Most carcinogens cause gene mutations that result in cancer.
3. Retroviruses carry segments of RNA that may produce genes associated with cancer.
4. Chromosomal abnormalities are found in people with particular forms of cancer.
5. Oncogenes promote and maintain the growth of cancerous tumors.

- 29.** Which statements indicate that environmental factors may cause cancer?
- A. 1 and 2
 - B. 2 and 3
 - C. 3 and 4
 - D. 4 and 5

Use the following information to answer the next two questions.

Antibiotics are chemicals produced by some micro-organisms to provide a defense against bacterial infection. Many antibiotics block or disrupt one or more stages in protein synthesis by bacteria. A few antibiotics inhibit cell division in bacteria. Some common antibiotics are described below.	
Antibiotic	Description
1. Chloramphenicol	<ul style="list-style-type: none">• Prevents the normal joining of mRNA with ribosomes• Inhibits the reaction that leads to the formation of bonds between amino acids
2. Streptomycin	<ul style="list-style-type: none">• Causes misreading of the genetic code in mRNA
3. Puromycin	<ul style="list-style-type: none">• Binds with the amino acid tyrosine and substitutes for the tRNA-tyrosine complex on ribosomes• Prevents the further addition of amino acids to a polypeptide when tyrosine is required
4. Actinomycin	<ul style="list-style-type: none">• Binds to DNA nucleotides• Inhibits the linking of nucleotides in mRNA or DNA
5. Tetracycline	<ul style="list-style-type: none">• Prevents binding of tRNA to the first codon in a mRNA molecule
6. Mechlorethamine	<ul style="list-style-type: none">• Binds to guanine in cytosine-guanine base pairs

30. Some antibiotics do not prevent the synthesis of protein by bacterial cells but do cause the cells to produce abnormal proteins. Two such antibiotics are numbered
- A. 1 and 2
B. 1 and 4
C. 2 and 3
D. 3 and 4
31. Two antibiotics that likely prevent the replication of bacterial DNA just before cell division begins are numbered
- A. 2 and 5
B. 2 and 6
C. 4 and 5
D. 4 and 6

Population growth of organisms is affected by interaction with the environment.

Use the following information to answer the next two questions.

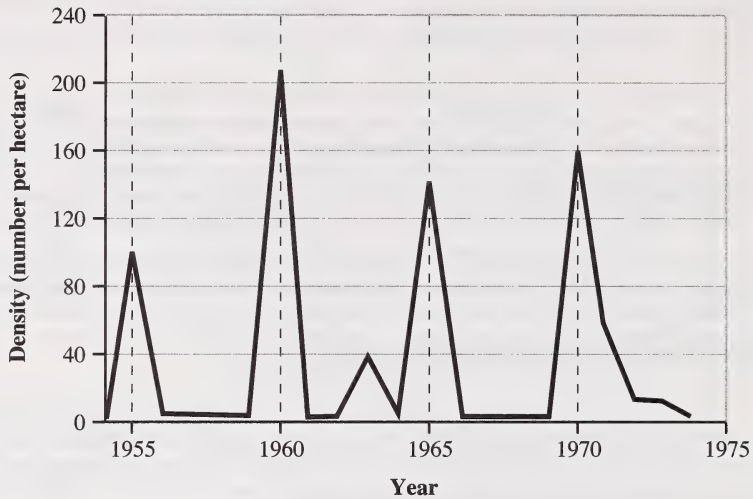
Sticklebacks are small fish that often have sharp spines on their bodies. In many small lakes and ponds in Alberta, the stickleback is the dominant species because of its ability to tolerate low oxygen levels. Some Alberta populations of sticklebacks lack spines. This trait is controlled by a recessive allele. The type of predator present affects the proportion of sticklebacks exhibiting this trait. Small northern pike, a carnivorous fish, prefer to feed on sticklebacks without spines. Predatory water beetles show a preference for those with spines.

A study in the late summer of 1993 found that 30% of the sticklebacks in Astotin Lake in Elk Island National Park did not have spines. Because of a large amount of snow the previous winter, Astotin Lake was temporarily connected by spring runoff to a pond that previously had no sticklebacks, and some sticklebacks migrated to the pond. In 1994, a survey indicated that 65% of the sticklebacks present in the pond lacked spines.

32. Water beetles are the dominant predator in the pond connected to Astotin Lake. If you continued to study this pond for a number of years, the proportion of spineless sticklebacks in the population would likely
- A. remain constant because breeding would be a random event
 - B. increase because of selective pressure on spined individuals
 - C. decrease because of selective pressure on spined individuals
 - D. remain constant because the spineless trait provides no reproductive advantage
33. Which statement best explains why the pond had a higher percentage of the spineless phenotype than the lake did?
- A. The dominant allele had a selective advantage in the pond.
 - B. There was an increase in the number of heterozygotes in the lake.
 - C. The founding population in the pond had a greater proportion of spineless individuals.
 - D. Fewer spineless individuals in the lake survived the summer when oxygen levels were low.

Use the following information to answer the next two questions.

Population Densities of Lemmings in Barrow, Alaska, 1954–1974



Lemmings are small, plant-eating rodents that live in underground burrows. The data were collected during surveys of an area of 24 hectares.

34. Which row correctly identifies two density-dependent (biotic) and two density-independent (abiotic) factors that likely affected the size of the lemming population from 1954 to 1974?

Row	Density-dependent Factors	Density-independent Factors
A	<ul style="list-style-type: none"> • average summer temperature • snow depth 	<ul style="list-style-type: none"> • number of predators • availability of grass
B	<ul style="list-style-type: none"> • number of predators • availability of grass 	<ul style="list-style-type: none"> • average summer temperature • snow depth
C	<ul style="list-style-type: none"> • length of days in summer • number of predators in winter 	<ul style="list-style-type: none"> • availability of grass • snow depth
D	<ul style="list-style-type: none"> • availability of grass • snow depth 	<ul style="list-style-type: none"> • length of days in summer • number of predators in winter

Continued

Numerical Response

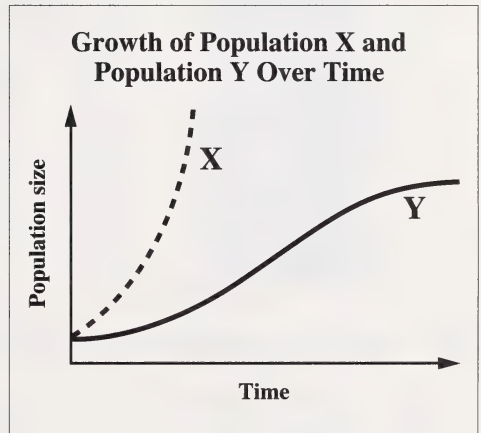
6. Calculate the total population size of the lemmings in 1970.

Answer: _____ lemmings

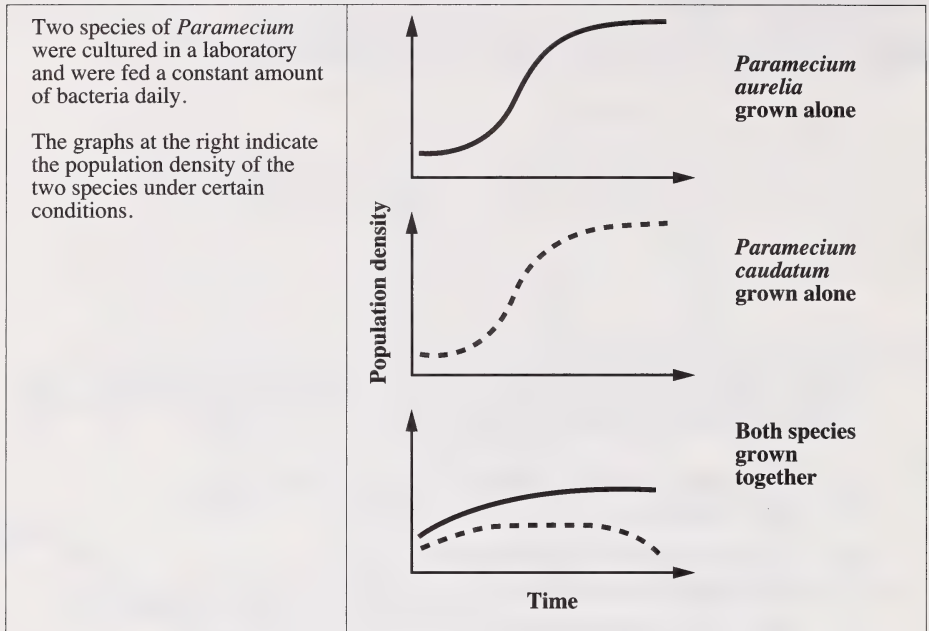
(Record your answer in the numerical-response section of the answer sheet.)

35. If population X and population Y were the same species, the graph at the right would indicate that population Y had a

- A. higher birth rate and death rate than population X
- B. greater number of immigrants and emigrants than population X
- C. higher death rate and a greater number of emigrants than population X
- D. higher birth rate and a greater number of immigrants than population X



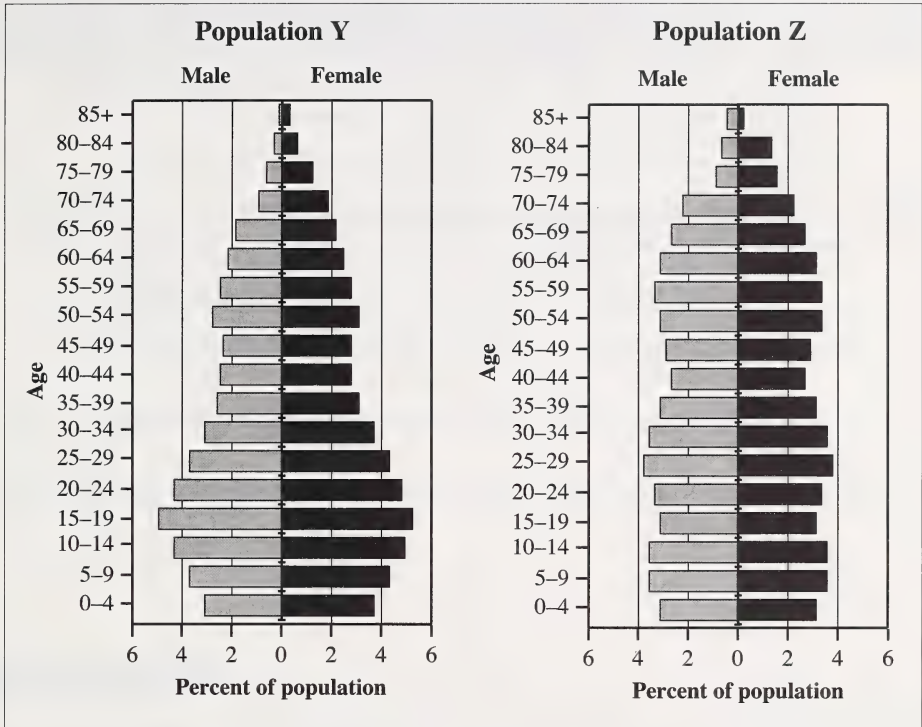
Use the following information to answer the next question.



36. Which nutritional relationship is best illustrated by the information?

- A. Commensalism
- B. Competition
- C. Parasitism
- D. Predation

Use the following graphs to answer the next question.



37. The impact of birth control technologies on a human population is best shown by population graph
- A. Y, ages 0 to 14
 - B. Y, ages 30 to 49
 - C. Z, ages 0 to 14
 - D. Z, ages 30 to 49

Use the following information to answer the next question.

Maple syrup urine disease (MSUD) is a recessive genetic disorder in which certain types of amino acids and their metabolic byproducts build up in the body, giving the urine the odour of maple syrup and causing many neurological disorders. MSUD is rare in the general population, but it continues to be a thousand times more common than normal among the Old Order Mennonite population of Pennsylvania.

- 38.** A likely reason for the continuing high incidence of MSUD in the Old Order Mennonite population is that
- A.** the climate of Pennsylvania increases the risk of getting the disorder
 - B.** this disorder cannot be diagnosed by amniocentesis or chorionic villus sampling
 - C.** a large number of individuals carrying the defective gene migrate to Pennsylvania
 - D.** marriages of Old Order Mennonites to people from the general population rarely occur

Characteristics of organisms are affected by their genome.

Use the following information to answer the next five questions.

Human blood is typed in several ways in addition to the ABO system. The blood types M, N, and MN are controlled by the codominant alleles L^M and L^N . The blood types Rh^+ (rhesus positive) and Rh^- (rhesus negative) are controlled by the dominant allele R (rhesus positive) and the recessive allele r (rhesus negative).

39. A possible genotype of a person with blood type A M Rh^+ is

- A. $I^A i L^M L^M rr$
- B. $I^A I^A L^M L^M Rr$
- C. $I^A i L^M L^N Rr$
- D. $I^A I^A L^M L^N RR$

Numerical Response

7. If a woman with type MN blood and a man with type N blood have a child, what is the probability that the child will have type MN blood?

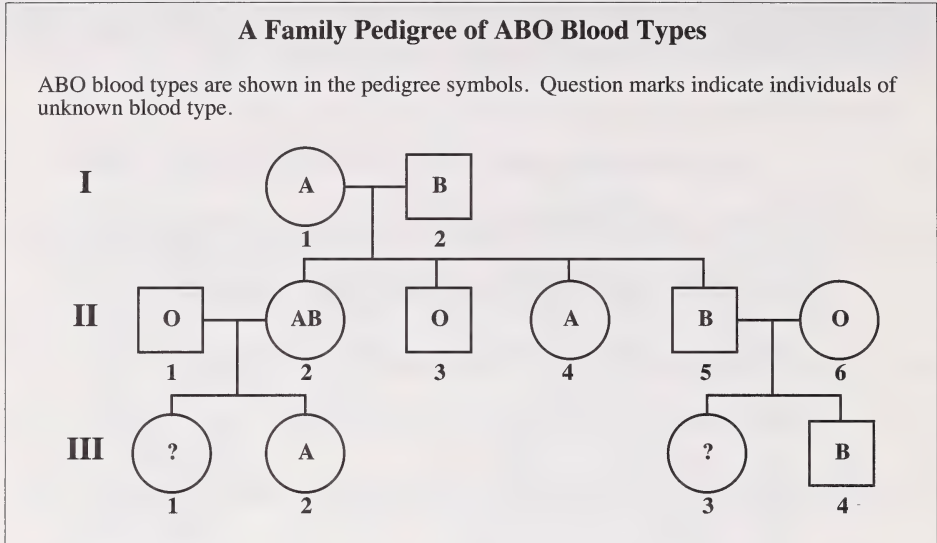
Answer: _____

(Record a value from 0 to 1 rounded to two significant digits in the numerical-response section of the answer sheet.)

40. Two men each claimed the same children as his own. The blood types of the men, the children, and their mother were known. Which test would likely solve the problem of identifying the father?
- A. Karyotyping
 - B. Amniocentesis
 - C. DNA fingerprinting
 - D. Chromosome mapping

Continued

Use this additional information to answer the next question.



41. A valid conclusion based on the pedigree is that
- A. individuals I 1 and I 2 both carry the allele i
 - B. individual II 3 would be unable to father children with type B blood
 - C. individual II 4 is homozygous for the allele I^A
 - D. individuals III 2 and III 4 are both homozygous for blood type alleles

Numerical Response

8. A man of unknown genotype with blood type A and a woman with blood type O are going to have a child. Depending on the man's genotype, the minimum probability that the child will have blood type O is zero. What is the maximum probability that the child will have blood type O?

Answer: _____

(Record a value from 0 to 1 rounded to two significant digits in the numerical-response section of the answer sheet.)

Use the following information to answer the next two questions.

**Dominance Hierarchy and Symbols for Eye Colour
in *Drosophila* (Fruit Fly)**

Phenotype	Genotypes	Dominant to
Wild type	E^1E^1 and E^1E^2 and E^1E^3 and E^1E^4	Apricot and honey and white
Apricot	E^2E^2 and E^2E^3 and E^2E^4	Honey and white
Honey	E^3E^3 and E^3E^4	White
White	E^4E^4	

42. A *Drosophila* with white eye colour was crossed with a *Drosophila* with apricot eye colour: 50% of the offspring had apricot eye colour and 50% had honey eye colour. The genotypes of the parents were E^4E^4 and

- A. E^1E^4
- B. E^2E^2
- C. E^2E^3
- D. E^2E^4

43. Which row correctly identifies the probability of certain offspring being produced from a cross of a wild-type fly carrying the allele for white and a wild-type fly carrying the allele for apricot?

Probability of Producing Offspring with a Certain Eye Colour				
Row	Wild type	Apricot	Honey	White
A	1.00	0.00	0.00	0.00
B	0.75	0.25	0.00	0.00
C	0.50	0.50	0.00	0.00
D	0.25	0.25	0.25	0.25

Use the following information to answer the next question.

In garden peas, the allele for tall plant height (T) is dominant over the allele for short plant height (t) and the allele for round seed shape (R) is dominant over the allele for wrinkled seed shape (r). The genes for these traits assort independently.

44. Consider the cross:

Plant I (tall–wrinkled seeds) × Plant II (tall–round seeds)

Which row correctly identifies the gametes that might be produced by these plants?

Row	Gametes Produced by Plant I	Gametes Produced by Plant II
A	Tr or tr only	TR, Tr, tR, or tr
B	TR, Tr, tR, or tr	TR, Tr, tR, or tr
C	Tr or tr only	TR or tr only
D	TR, Tr, tR, or tr	TR or tr only

Use the following information to answer the next question.

In dogs, the allele *B* produces a black coat and the recessive allele *b* produces a brown coat. Allele *W*, located on a separate chromosome, prevents the formation of pigment, thereby preventing the development of coat colour. The recessive allele *w* does not prevent the development of coat colour.

45. A male and female dog both have the genotype BbWw. If mated, the probability of these dogs producing offspring with a black coat would be

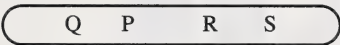
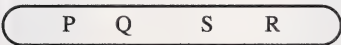


- A. $\frac{1}{8}$
B. $\frac{1}{4}$
C. $\frac{3}{16}$
D. $\frac{3}{4}$

46. Turner syndrome is an inherited condition in which one of the two X chromosomes normally present in each cell is missing. This syndrome affects 1 in 2 500 females. Turner syndrome is likely a result of
- abnormal crossing over during synapsis
 - nondisjunction of sex chromosomes during meiosis
 - a gene mutation during chromosomal duplication in interphase
 - chromosomal mutations in which autosomes are broken and lost
47. Hypophosphatemia is an X-linked dominant disorder that causes a type of rickets. Which statement about people with this disorder is likely true?
- Affected heterozygous females would transmit the trait to all of their sons.
 - Affected males would produce all affected sons and no affected daughters.
 - Affected males would produce all affected daughters and no affected sons.
 - Affected heterozygous females would transmit the trait to all of their daughters.

Use the following information to answer the next question.

Crossover Frequencies for Some Genes on an Autosome of Organism Z

Genes	Crossover Frequency
P and Q	5%
P and R	8%
P and S	12%
Q and R	13%
Q and S	17%

48. Which chromosome map **best** represents the sequence of genes on the autosome from organism Z?
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Biotechnologies are used to further our knowledge of the plant and animal kingdoms.

Use the following information to answer the next question.

Genetically Engineered Plants on Trial

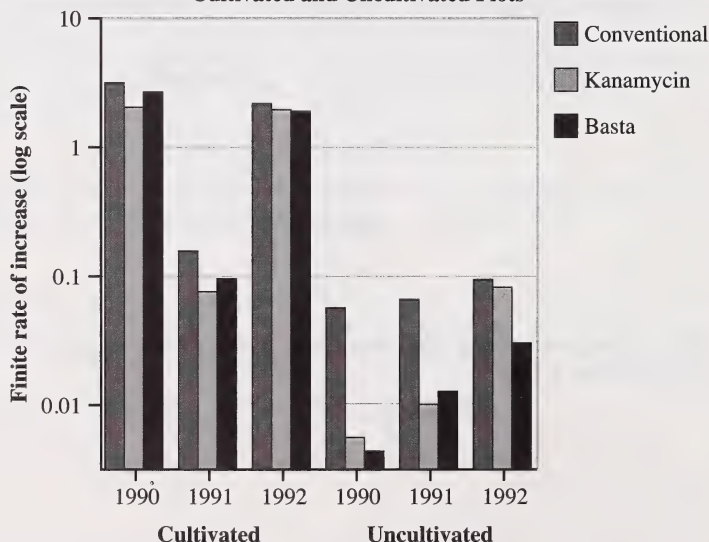
M. J. Crawley and his colleagues in England performed an ecological study that addressed the debate about the use of genetically engineered plants in agriculture. The debate centres on the possible invasion of such plants into natural habitats where they are not wanted.

Crawley's study used both genetically engineered and conventional (unmodified) canola plants. The conventional variety of canola is commonly grown in Alberta as a crop. Two genetically engineered varieties included one tolerant to the herbicide glufosinate (Basta variety) and one that expressed a tolerance to the antibiotic kanamycin (Kanamycin variety).

The three varieties of canola were grown from 1990 to 1992 in cultivated and uncultivated plots. From the data, a comparison of the ecological performance of the three different genetic lines was made.

The growth of the three varieties of canola was also tested in four different climatic conditions (wet versus dry and sunny versus shady).

Finite Rate of Increase for Three Varieties of Canola in Cultivated and Uncultivated Plots



The finite rate of increase is a measure of the ability of a plant to survive and increase in number in an environment. If the finite rate of increase is greater than 1, the plant will increase in abundance. If it is less than 1, the plant will decline to extinction. The cultivated plots were cleared of all vegetation before planting. Uncultivated plots had intact native vegetation.

Continued

Written Response – 12 marks

- 1.** a. State three conclusions that can be made based on the data.

(3 marks)

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- b. Provide one reason for the differences in the finite rates of increase of canola in cultivated plots compared to canola in uncultivated plots.

(1 mark)

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Continued

(2 marks)

- c. The significance of Crawley's study is not so much the outcome of the study but that the thoroughness of the study sets a standard for future experiments of this nature. Identify two ways in which this study illustrates good scientific research skills.

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(2 marks)

- d. Describe one advantage and one disadvantage of the development of herbicide-resistant crop plants like the Basta variety described in this study. (Herbicides are substances that kill plants.)

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Continued

Canola is an annual with a simple life cycle. Seeds germinate in the spring. Flowering and seed ripening occur during the summer. Seed is shed in early fall.

To determine the survival rate of germinating seeds in uncultivated plots, 400 seeds of each of the three varieties of canola were buried below the natural vegetation in flat nylon-mesh beds in each of 12 habitats. Also buried were 400 Charlock seeds, a naturally occurring, "wild" relative of canola.

The table shows the total number of seeds that germinated (out of the 400 of each type originally buried) in each of the 12 habitats.

Habitat Number	Conventional Variety	Kanamycin Variety	Basta Variety	Charlock
1	37	4	10	218
2	3	2	0	144
3	5	2	0	243
4	0	0	4	180
5	60	1	1	302
6	16	11	0	322
7	0	0	1	239
8	2	0	1	256
9	0	0	1	50
10	28	2	1	263
11	16	6	0	324
12	6	0	2	341

- e. Determine the survival rate (%) for each of the three varieties of canola seeds and the Charlock seeds originally buried in **habitat 1**. Show your method.

(2 marks)

Continued

(1 mark)

- f. What was the purpose of burying the Charlock seeds in this experiment?

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(1 mark)

- g. Based on the survival data, provide a hypothesis about the invasion of canola used in agriculture into natural habitats in Alberta.

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Use the following information to answer the next question.

As technologies have been developed to observe and manipulate cells, cell organelles, and molecules within cells, our knowledge of the structures and functions of cells has increased dramatically. Gaining an understanding of cell structure and function is an important step in furthering our knowledge of reproduction, growth, and development.

Written Response – 12 marks

2. Describe two technologies that have been developed to observe and/or manipulate cells, cell organelles, and/or molecules. Provide a specific example of how each of these technologies has furthered our knowledge of organisms. Evaluate the impact of observational and/or manipulative technologies on society and/or human population growth.

Be sure that your response

- describes two appropriate technologies (procedures, methods, or equipment) used to observe or manipulate (change the structure or function of) cells or cell components
- provides a specific example of how each of those two technologies has extended our knowledge of organisms
- evaluates the impact or effect of the use of observational and/or manipulative technologies in general on society and/or human population growth (by pointing out two pros and two cons)

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*You have now completed the examination.
If you have time, you may wish to check your answers.*



BIOLOGY DATA

Symbols

Symbol	Description
A	area
B	births during time interval
b	per capita births $\left(\frac{B}{N}\right)$
D	deaths during time interval
d	per capita deaths $\left(\frac{D}{N}\right)$
D_p	population density
K	carrying capacity
N	population size
ΔN	change in population size
$PG\%$	population growth (percent)
r	per capita population growth rate ($b - d$)
V	volume

Symbol	Description
$>$	greater than, dominant over
$<$	less than, recessive to
$=$	equal to, codominant with, incompletely dominant with
$/$	divided by, "out of"
\times	multiplied by, times, crossed with, mated with
Δ	change
σ^7	male
ϕ	female
n	chromosome number
I^A, I^B, i	alleles (human blood type) ABO system ($I^A = I^B, I^A > i, I^B > i$)
t	time
Δt	change in time

Equations

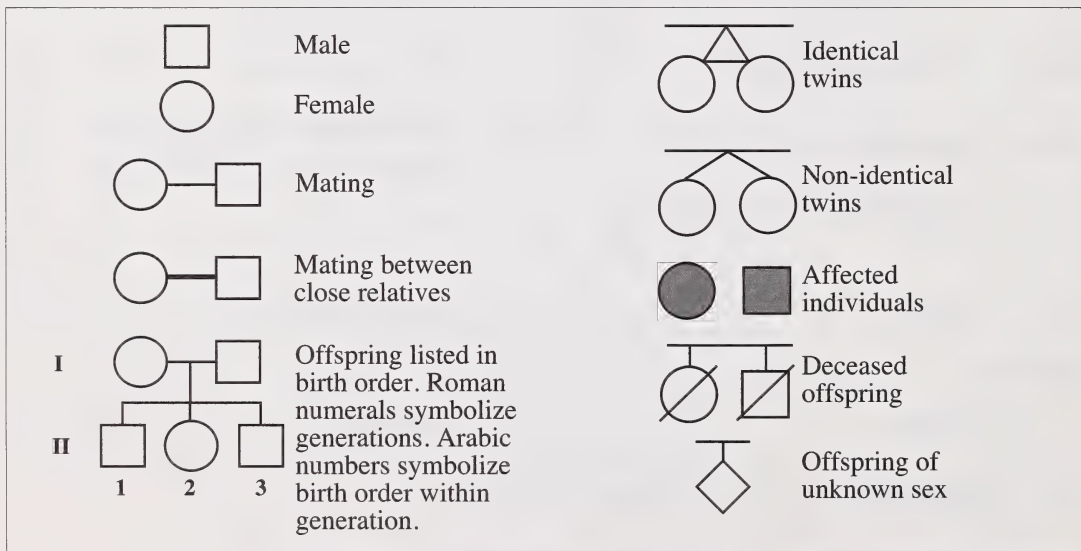
Subject	Equation
Hardy-Weinberg principle	$p^2 + 2pq + q^2 = 1$
Population density	$D_p = \frac{N}{V}$ or $D_p = \frac{N}{A}$
Change in population size	$\Delta N = (\text{factors that increase pop.}) - (\text{factors that decrease pop.})$
Population growth (%)	$PG\% = \frac{\Delta N \times 100\%}{N}$

BIOLOGY DATA

Abbreviations for Some Hormones

Hormone	Abbreviation
Adrenocorticotropin hormone	ACTH
Antidiuretic hormone	ADH
Follicle stimulating hormone	FSH
Human chorionic gonadotropin	HCG
Luteinizing hormone	LH (formerly ICSH in males)
Parathyroid hormone	PTH
Prolactin	PRL
Somatotropin (human growth hormone or growth hormone)	STH (HGH or GH)
Thyroid stimulating hormone	TSH

Pedigree Symbols



BIOLOGY DATA

Messenger RNA Codons and Their Corresponding Amino Acids

		S	E	C	O	N	D	B	A	S	E		
		U		C		A		G					
F	U	UUU	Phe	UCU	Ser	UAU	Tyr	UGU	Cys	U	T		
		UUC	Phe	UCC	Ser	UAC	Tyr	UGC	Cys	C			
I		UUA	Leu	UCA	Ser	UAA	STOP**	UGA	STOP**	A	H		
		UUG	Leu	UCG	Ser	UAG	STOP**	UGG	Trp	G			
R												I	
S	C	CUU	Leu	CCU	Pro	CAU	His	CGU	Arg	U			
		CUC	Leu	CCC	Pro	CAC	His	CGC	Arg	C	R		
T		CUA	Leu	CCA	Pro	CAA	Gln	CGA	Arg	A			
		CUG	Leu	CCG	Pro	CAG	Gln	CGG	Arg	G	D		
B	A	AUU	Ile	ACU	Thr	AAU	Asn	AGU	Ser	U			
		AUC	Ile	ACC	Thr	AAC	Asn	AGC	Ser	C			
		AUA	Ile	ACA	Thr	AAA	Lys	AGA	Arg	A	B		
		AUG	Met or START*	ACG	Thr	AAG	Lys	AGG	Arg	G			
A												A	
S	G	GUU	Val	GCU	Ala	GAU	Asp	GGU	Gly	U			
		GUC	Val	GCC	Ala	GAC	Asp	GGC	Gly	C	S		
E		GUA	Val	GCA	Ala	GAA	Glu	GGA	Gly	A			
		GUG	Val	GCG	Ala	GAG	Glu	GGG	Gly	G	E		

* Note: AUG is an initiator codon but also codes for the amino acid methionine.

** Note: UAA, UAG, and UGA are terminator codons.

Abbreviations for Amino Acids

Amino Acid	Abbreviation
Alanine	Ala
Arginine	Arg
Asparagine	Asn
Aspartate	Asp
Cysteine	Cys
Glutamate	Glu
Glutamine	Gln
Glycine	Gly
Histidine	His
Isoleucine	Ile
Leucine	Leu
Lysine	Lys
Methionine	Met
Phenylalanine	Phe
Proline	Pro
Serine	Ser
Threonine	Thr
Tryptophan	Trp
Tyrosine	Tyr
Valine	Val

Information About Nitrogen Bases

Nitrogen Base	Classification	Abbreviation
Adenine	Purine	A
Guanine	Purine	G
Cytosine	Pyrimidine	C
Thymine	Pyrimidine	T
Uracil	Pyrimidine	U

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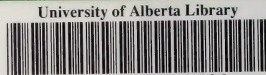
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